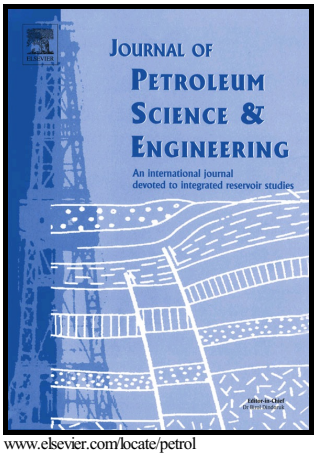

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Mohamed Mahmoud, Assad Barri, Salaheldin Elkatatny

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Mixing Chelating Agents with Seawater for Acid Stimulation Treatments in Carbonate Reservoirs

Mohamed Mahmoud*, Assad Barri, and Salaheldin Elkatatny

King Fahd University of Petroleum and Minerals

***Corresponding author.**

Abstract

Chelating agents are used to remove formation damage created by the drilling fluid filter cake in oil and gas wells. They were also used to remove the precipitation of scales around the perforation tunnels, inside tubing, and in surface facilities. Recently, chelating agents were introduced as stand-alone stimulation fluids to stimulate carbonate and sandstone reservoirs. Many studies were conducted on chelating agents and confirmed their ability to remove the damage and create wormholes in carbonate cores. Most of the previous studies focused on the effect of mixing chelating agents with fresh water in matrix stimulation. The stimulation process in offshore wells requires lots of fresh water and this will add more cost to the stimulation treatment due to the transportation requirements.

In this study, the effect of mixing chelating agent with seawater on the matrix stimulation was investigated. The matrix simulation treatments were conducted at different conditions of temperature, chelating agent concentration, and injection rate. The optimum injection rate and concentration of the chelating agent were determined using coreflooding experiments. New optimization process was introduced based on the volume and time requirements to execute the acid stimulation job. The effect of chelating agent concentration on the interfacial tension was also investigated. The optimum injection rate was determined for the 20 wt% hydroxy ethylene diamine tri acetic acid (HEDTA) chelating agent for different core lengths and this was compared to the estimated optimum injection rate.

The results of this study confirmed the existence of an optimum injection rate at different temperatures. Also it proposed an optimum chelating agent's concentration that gave an economic stimulation treatment. The comparison between matrix stimulation using chelating agent prepared by deionized water and that prepared using seawater concluded that seawater can be used instead of fresh water in matrix stimulation. The new proposed method that depends on the volume and time can be used effectively to determine the volume and time of the stimulation treatment. We found good match between the optimum injection rate determined in the laboratory and the estimated one.

Keywords;

HEDTA chelating agent, Seawater, carbonate cores, stimulation, optimum injection rate.

1.0 Introduction

Matrix stimulation is a term given to the process conducted on a production or injection well to improve the productivity or injectivity of the well after a severe decrease in production or injection rate. In this process, a chemical fluid with specific properties is injected inside the targeted formation to dissolve any precipitations around the wellbore and create tiny holes (wormholes) inside the formation. The created wormholes play an important role in facilitating the flow of hydrocarbons from the reservoir to the wellbore [1]. The success of stimulation treatment depends mainly on the radius of stimulated area inside the formation. The productivity of the well can be doubled if the stimulation fluid reached a distance of 10 ft radius from the wellbore [2]. This gives a light on the fact that enough amount of life acid must penetrate to a certain distance to make a noticeable change in the reservoir permeability. Even though, it was recognized that a radius of a formation damage greater than 1 to 3 ft from the wellbore in carbonate formations cannot be removed by hydrochloric acid (HCl) acid treatment. There are many dissolution patterns can be formed due to the combined effects of acid propagation, reaction kinetics, and rock heterogeneity [3]. These patterns were studied and reported by many authors [4-6].